

Internal Charging of Spacecraft in Jupiter's Radiation Belt

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The electron population in Jupiter's radiation belt is 10 times more intense than the earth's radiation belt. Therefore, the occurrence of anomalies due to electron charging can be a serious concern for Jupiter bound spacecraft. When Pioneer and Voyager went by Jupiter, numerous anomalies were experienced in the jovian radiation belt. A thorough investigation of these anomalies indicated that the major cause of a majority of the anomalies is the internal charging of the spacecraft components by energetic electrons. Based on this knowledge, a comprehensive program was initiated to develop and implement the design requirements and guidelines to protect the Galileo spacecraft from internal discharging. In its recent encounter with Jupiter's radiation belt, Galileo functioned properly without a single internal charging related anomaly indicating the success of this program.

This paper discusses the work that was done on the Galileo spacecraft on internal charging avoidance. It also presents an estimate of the charging levels of the spacecraft components based on the information obtained on Jupiter's radiation environment by the Galileo spacecraft. In addition, it discusses how the Galileo internal charging program can be applied to earth orbiting satellites, and also identifies the needed follow-on work in the area of internal charging.